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RACE FOR THE DECISIVE WEAPON

British, American, and Japanese Carrier Fleets, 1942–1943

James P. Levy

It is popularly understood that after the spectacular American victory at the battle of Midway the aircraft carrier reigned supreme; that war at sea was changed completely; and that the presence of America's two surviving carriers after the sinking of Admiral Chuichi Nagumo's four flattops forced the cancellation of the Midway invasion and the retreat of Admiral Isoroku Yamamoto's eleven battleships, sixteen cruisers, and fifty-three destroyers from the Central Pacific.[1] The reality was more complex. Midway was, in fact, followed by nearly two years of war in which carriers notably failed to deliver knockout blows of the kind most proponents of new technology promise for their innovations. Even at the battle of the Philippine Sea, despite the lopsided carrier-air duel, more damage was inflicted on the Imperial Japanese Navy's ships by U.S. submarines than by carrier aircraft.[2] This is not to say that carriers were unimportant, just that they spent more of their time in Corbettian activities like providing cover for amphibious landings than in Mahanite fleet-to-fleet combat. Most naval battles in 1942–43 involved cruisers and destroyers rather than carriers. Of the seventeen engagements fought between the U.S. and Imperial Japanese navies in the Solomons, fifteen were fought by surface ships, two by carriers.[3]

> We think of the Pacific war as the "war of the carriers" and the "beginning of the carrier age." Well, that's technically true. But keep in mind that only five carrier-to-carrier battles were fought during the entire war. . . . The "carrier-versus-carrier era" lasted only twenty-five months . . . [a]nd actually, the last carrier-to-carrier combat that was anything like an even fight was in October 1942. . . . In effect, the "Golden Age of Carrier Battles" lasted from May to October 1942.[4]

In Europe, the major naval battles in Europe during 1942–43—the Barents Sea and the North Cape—were gunnery actions. Yet by 1944, everyone agrees, carriers ruled the waves. Why was it that the primacy of the aircraft carrier heralded at Taranto and Pearl Harbor, and confirmed at Midway, did not immediately come to pass? Why did not carrier forces from that day forward completely dominate naval combat? This seeming discrepancy between the emergence of the carrier as the dominant capital ship in 1942 and its full manifestation as the decisive weapon in naval warfare in 1944 was caused by a chronic shortfall in carriers and operational aircraft. This was true of all three "carrier powers": Britain, the United States, and Japan. They all knew what was needed, but previous losses, ongoing attrition, and regular maintenance made the massing of an overwhelming carrier fleet impossible. Only with the introduction of numerous *Essex*-class ships, along with a mass of trained pilots and excellent carrier planes, was the promise of Midway turned into reality.

This article will compare and contrast the carrier fleets of Great Britain, the United States, and Japan. In addition, it will examine their activities in the post-Midway strategic environment and see how each carrier power responded to the perceived need for additional carrier airpower. We will see how and why the United States won the race for the decisive weapon of modern naval warfare.

A note on the carriers available to the Americans, Japanese, and British in 1942–43 is in order. Carriers came in three main types: fleet, light fleet, and escort. We will limit our discussion here to fleet and light fleet carriers.

As we can see in table 1, the U.S. Navy's largest operational carrier in 1942 was its oldest—*Saratoga*. However, it was torpedoed on two separate occasions early in the war and was out of service for months.[5] Also operational during this period were the *Enterprise* and *Hornet,* but *Hornet* was sunk by the Japanese on 24 October 1942. The *Wasp* served in the Pacific briefly but was sunk by a submarine on 15 September 1942. The *Ranger* was classified as a fleet carrier, but because it had trouble reaching its designed speed and was very lightly protected, it was deemed unsuitable for Pacific Fleet operations. (It did serve in the Operation TORCH landings in Morocco and again with the Royal Navy's

TABLE 1
U.S. NAVY CARRIERS 1942–1943

Name	Full-Load Displacement	Speed (knots)	Aircraft Complement*
Saratoga	43,000	33	63
Ranger	17,500	29	72
Enterprise, Hornet	25,400	32.5	84
Wasp	18,450	29.5	76
Essex Class	34,800	32.5	90
Independence Class	14,700	31	30

* Theoretical total aircraft complement: 379

Home Fleet in the summer of 1943.) The U.S. Navy did not operate light fleet carriers until the summer of 1943, when the first of nine *Independence*-class ships, built from converted light cruiser hulls, made their appearance. All nine were completed in 1943, but only the first four were in action by the end of that year. More critical for U.S. Navy operations were the big *Essex* carriers on the way in 1942; four joined the Pacific Fleet by November 1943, with ten more building. It was these carriers that would sweep the Pacific.

The Imperial Japanese Navy (IJN) operated a substantial carrier fleet in 1942–43, as we can see in table 2. Despite the losses at Midway, Japanese carriers proved themselves a match for American ones in the battles around the Solomons. The centerpieces of their carrier force were the sisters *Shokaku* and *Zuikaku*—well armored and fast, and with large air groups. They were probably the best carriers afloat until the *Essex* class commissioned. The converted liners *Junyo* and *Hiyo* were much less impressive, with little armor, inadequate speed, and suspect engines. The light carrier *Zuiho* was a fine ship and served its country well. Confusingly, Japan successively commissioned two light carriers named *Ryuho*. U.S. carrier planes sank the first on 24 August 1942; it was replaced by a converted submarine depot ship that proved a disappointment in service. No new fleet carriers joined the IJN in 1943, but the armored fleet carrier *Taiho* and the light fleet carriers *Chitose* and *Chiyoda* were due to enter service in early 1944.

TABLE 2
IMPERIAL JAPANESE NAVY CARRIERS 1942–1943

Name	Full-Load Displacement	Speed (knots)	Aircraft Complement*
Shokaku, Zuikaku	32,105	34	72
Junyo, Hiyo	28,300	25	53
Zuiho	14,200	28	30
Ryuho1	8,000	29	37
Ryuho2	13,366	26	31
Taiho	37,000	33	72
Chitose, Chiyoda	15,300	29	30

*Theoretical total aircraft complement: 317

Table 3 gives us the details of Royal Navy carriers. The hard-to-categorize carrier *Eagle* served with the fleet briefly during the period under discussion.[6] It was a converted First World War–era battleship, and this author tends to categorize it as a light fleet carrier. *Eagle* spent its distinguished wartime career in the Mediterranean, where it was sunk by U-boat torpedoes during Operation PEDESTAL in August 1942. The British had five fleet carriers in commission during 1942–43: *Furious, Illustrious, Formidable, Victorious,* and *Indomitable*. *Furious* was a converted light battle cruiser, and despite age and dodgy engines that often sent it back to port for repairs, it performed yeoman service. *Illustrious, Formidable,* and *Victorious* were sturdy, well-armored carriers that sacrificed air

TABLE 3
ROYAL NAVY CARRIERS 1942–1943

Name	Full-Load Displacement	Speed (knots)	Aircraft Complement*
Eagle	22,600	24	21
Furious	22,450	30	36
Illustrious, Formidable, Victorious	28,620	30.5	33
Indomitable	29,730	30.5	45
Unicorn	20,300	24	35
Implacable Class	32,110	32	60

*Theoretical total aircraft complement: 236

complement (normally thirty-three to thirty-six aircraft) for deck and side protection.[7] They could carry additional aircraft by parking planes on the flight deck (which was standard American practice but contrary to Royal Navy policy). Their half-sister *Indomitable* had been redesigned during construction with somewhat less armor but additional hangar space. Two fleet carriers *(Implacable, Indefatigable)* that would join the fleet in 1944 struck a good balance of armament, speed, and air complement. The unique *Unicorn* had been designed before the war as a maintenance carrier to support overseas deployments. It was pressed into service as a light fleet carrier in 1943.

As can be seen from table 4, carrier strength fluctuated widely throughout the period in question. The table clearly reveals how well major naval operations dovetail with carrier availability. One sees this with Operation WATCHTOWER (the Tulagi/Guadalcanal landings) in August 1942, Operation PEDESTAL the same month, TORCH in November 1942, and Operation HUSKY (the Sicily invasion) in July 1943. Operation GALVANIC, the Tarawa/Makin amphibious assaults, took place as soon as enough *Essex* and *Independence*-class carriers were ready for action, in November 1943. The exception to this pattern is the Japanese carrier force's inaction during 1943, for reasons discussed below. The IJN's carriers withdrew from combat after their costly victory at the battle of Santa Cruz in October 1942 and did not sortie again until June 1944. However, Japanese carrier planes, sans carriers, operated repeatedly from land bases throughout 1943.

Carriers are useless as combatants without proper aircraft. After the availability of hulls, the factors that determine the power and effectiveness of carrier forces are the number and quality of planes embarked and the training of their aircrews. In this respect the United States held a distinct edge over Britain and Japan. (The characteristics of the various aircraft types in use during the period under discussion are summarized in table 5.) The British were dependent on short-range fighters converted from land use and a slow biplane torpedo bomber for most of 1942–43. This is not to say that the Sea Hurricane, Seafire, and Albacore were objectively bad aircraft. What hurt them was how they fit into midwar carrier operations. The Seafire was basically an interceptor, with a weak undercarriage prone to damage and landing accidents. The British had a true

TABLE 4
OPERATIONAL CARRIER STRENGTH JULY 1942–NOVEMBER 1943

	Imperial Japanese Navy		Royal Navy		U.S. Navy	
	Fleet	Lt. Fleet	Fleet	Lt. Fleet	Fleet	Lt. Fleet
July '42	S		VIFIL	E	ESWR	
August	SZ	R	VIFILFu	E	ESWR	
September	SZ	Zu	ILFu		ESRH	
October	SZJH	Zu	ILFu		ERH	
November	ZJ		VFILFu		ER	
December	ZJ		VFILFu		ES	
January '43	ZJ	Zu	FILFu		ES	
February	ZJ	Zu	VFILFu		ESR	
March	ZJH	ZuR2	VFFu		ESR	
April	ZJH	ZuR2	VIFFu		ESR	
May	SZJH	ZuR2	VIF		SR	
June	SJ	R2	VIF	U	SR	
July	SZ	ZuR2	VIFILFu		SR	
August	SZJ	Zu	VFIL	U	EsYSR	In
September	SZJ	Zu	VFIL	U	LSR	InPBw
October	SZJH	ZuR2	VFILFu		EsYSRL	InPBwC
November*	SZH	ZuR2	VFu		EsYRLBhE	InPBwC

KEY

Japan: S = *Shokaku,* Z = *Zuikaku,* J = *Junyo,* H = *Hiyo,* R = *Ryuho,* Zu = *Zuiho,* R2 = 2nd *Ryuho*

Royal Navy: V = *Victorious,* I = *Indomitable,* IL = *Illustrious,* F = *Formidable,* Fu = *Furious,* E = *Eagle,* U = *Unicorn*

U.S. Navy: E = *Enterprise,* S = *Saratoga,* W = *Wasp,* R = *Ranger,* H = *Hornet,* Es = *Essex,* Y = *Yorktown,* L = *Lexington,* Bh = *Bunker Hill,* In = *Independence,* P = *Princeton,* Bw = *Belleau Wood,* C = *Cowpens*

Sources: A. J. Watts and B. G. Gordon, *The Imperial Japanese Navy* (Garden City, N.Y.: Doubleday, 1971); E. Bergerud, *Fire in the Sky* (Boulder, Colo.: Westview, 2000); N. Friedman, *British Carrier Aviation* (Annapolis, Md.: Naval Institute Press, 1988); H. A. Gailey, *The War in the Pacific* (Novato, Calif.: Presidio, 1995); H. Jentschura, *Warships of the Imperial Japanese Navy* (Annapolis, Md.: Naval Institute Press, 1977); *Dictionary of American Naval Fighting Ships,* ed. J. L. Mooney (Washington, D.C.: U.S. Government Printing Office, 1959–67); grateful acknowledgment is extended to D. Ashby of the Naval Historical Branch London and C. Rounsfell of the Fleet Air Arm Museum Yeovil for help in compiling this table.

**Saratoga* left service for major refit after the first week of November 1943.

carrier fighter that could escort strike formations, the Fulmar, but it was too slow to deal with modern opposition. The Albacore was optimized as a torpedo bomber, and most Albacore crews were trained for night antishipping strikes with torpedoes. Many Albacores had surface search radar attached to their underbellies.

Unfortunately, the Royal Navy in 1942–43 needed an aircraft for bombing and close air support much more than an obsolescent torpedo plane best suited to antishipping strikes. The Barracuda, though not the failure it is sometimes portrayed as having been, was not the major improvement the Fleet Air Arm (FAA) needed. Its deficiencies forced the British to procure U.S. planes under Lend-Lease. British pilots were good, but relatively small carrier air groups and less than stellar aircraft limited FAA effectiveness. A comparison of air groups in the summer of 1943 is illuminating. When the name-ship of the *Essex* class became operational, it carried an air group of thirty-six Hellcats, thirty-six

TABLE 5
CARRIER AIRCRAFT

	User	Max. Speed (knots)	Combat Radius (nm)	Armament
FIGHTERS				
Zero	IJN	267	335	2 x 20 mm, 2 x 7.7 mm
Fulmar	RN	211	275	8 x .303-in.
Sea Hurricane	RN	252	200	4 x 20 mm
Seafire	RN	289	237	2 x 20 mm, 4 x .303-in.
Wildcat	USN/RN	274	265	4 x .50-in.
Hellcat	USN/RN	280	324	6 x .50-in.
TORPEDO BOMBERS				
Kate	IJN	178	209	1 x 21-in. torpedo
Jill	IJN	225	355	1 x 21-in. torpedo
Albacore	RN	122	348	1 x 18-in. torpedo
Barracuda	RN	198	196	1 x 21-in. torpedo or 1 x 1,600-lb. bomb
Avenger	USN/RN	209	348	1 x 24-in. torpedo or bombs (2,000 lbs.)
DIVE-BOMBERS				
Val	IJN	201	332	816 lbs.
Judy	IJN	272	450	1,300 lbs.
Dauntless	USN	192	382	1,000 lbs.
Helldiver	USN	222	652	1,000 lbs.

Sources: Owen Thetford, *British Naval Aircraft since 1912,* 6th rev. ed. (Annapolis, Md.: Naval Institute Press, 1991); and James F. Dunnigan and Albert A. Nofi, *Victory at Sea* (New York: William Morrow, 1995).

Dauntlesses, and eighteen Avengers—a staggering ninety aircraft.[8] That July *Indomitable* embarked thirty Seafires and twenty-one Albacores, while *Formidable* had six Seafires, twenty Martlets (the British name for Wildcats), and eighteen Albacores aboard—in all, ninety-five planes. Thus these two British carriers together only roughly equaled the combat power of *Essex* alone. Their only advantage over a single *Essex*-class ship would have been that two hulls are harder to disable than one, and RN carriers had a slight edge in armor and survivability. By way of comparison, in October 1942 *Zuikaku* operated its designed maximum of seventy-two aircraft: twenty-seven Zeroes, twenty-seven Vals, and eighteen Kates.[9] In terms of planes, the U.S. Navy and Marine Corps during 1942 averaged 3,191 combat aircraft in their collective inventory; the Fleet Air Arm fielded 461 combat aircraft in frontline service (carrier and land-based) in September of that year.[10]

Also problematic for the British was carrier doctrine. Rear Admiral Reginald Henderson had experimented with multicarrier operations in the early 1930s. The 1939 Fighting Instruction specified that the role of the carriers was to "deny the use of aircraft to the enemy" by finding and sinking his carriers.[11] When war came, the Home Fleet had a flag officer, "Vice Admiral Aircraft Carriers," tasked

with overall control of carrier operations. He had up to three carriers under his direct command *(Ark Royal, Furious,* and *Glorious)* during the Norwegian campaign in May and June 1940—although they tended to work in pairs, two on operations and one back at Scapa Flow (in the Orkneys) refueling.[12] Even the strike on Taranto, Italy, in November 1940 was to have been a multicarrier operation, but damage to *Eagle* precluded its participation.[13] However, in 1943 opinion was still divided within the RN on how many carriers could work together effectively, whether each carrier should have its own screen or all should share a collective one, and whether one carrier should maintain the defensive combat air patrol overhead or each should contribute a small number of fighters to a combined CAP.[14] Although the RN was prepared to use up to three carriers together defensively (as in Operation PEDESTAL, the crucial relief convoy for Malta in August 1942), it lacked experience and training in multicarrier offensive operations. Because carriers were so widely needed, and because of losses, battle damage, overhauls, and transit times to the many theaters of operation, the British rarely got the chance to mass their carriers. So even if the Royal Navy had had a coherent carrier doctrine based on massive strikes delivered by massed carriers, as the United States and Japan did, real-world demands would have militated (as in fact they did) against its implementation.

British operational procedure was also different, partly for philosophical reasons, partly for practical ones. To avoid corrosion from constant exposure to sea spray and reduce the risk of multiple losses in landing accidents, British practice was to strike aircraft immediately below into the hangar upon landing, not park them on the flight deck forward. This made sense, given the paucity of British planes and typical Atlantic sea conditions. However, combined with the slow speed of British aircraft, it meant that RN air groups took more time launching, forming up, and landing than did their U.S. and Japanese counterparts. This consumed fuel, reduced combat radius significantly, and slowed the tempo of operations.[15]

By contrast, Japanese carrier planes were very good. Two outstanding aircraft, the Judy dive-bomber and the Jill torpedo plane, entered service in large numbers by the end of 1943. However, the Zero remained in the order of battle long after the American Hellcat made it obsolete. Losses were hard to make up, and replacement-pilot quality was low. The IJN devoted great effort after Midway to revamping its naval air force, but the process took two years. By then, the United States, with twice Japan's population and ten times its gross national product, had far outstripped anything Japan could hope to match in terms of ships, planes, or trained personnel.

The U.S. Navy, after the replacement of the Devastator with the Avenger, had no real weakness in its air arsenal, and its training program and rotation policy could produce high-quality pilots with ease. Crucial in the period under

discussion was the replacement of the very good Wildcat with the excellent Hellcat; the capture of a crashed, yet largely intact, Zero fighter in the Aleutians in June 1942 helped American designers produce in the Hellcat a superb Zero-killer. Late in 1943 the Dauntless dive-bomber was replaced by the marginally better Helldiver. Overall, by November 1943 the U.S. Navy enjoyed a spectacular advantage over the RN and the IJN in the sheer bulk of high-quality ships, planes, and aircrews it could throw into action. Even in the interwar years planes and pilots had not been in as short supply in the U.S. Navy as they had been in the Royal Air Force–dominated Fleet Air Arm or the quality-obsessed IJN, wedded to the "invincibility of refined technique."[16]

American carrier doctrine flowed out of the big air wings of *Lexington* and *Saratoga*. It has been argued that tests using these large air groups prior to World War II made the U.S. Navy uniquely conscious of the emerging primacy of the aircraft carrier. This assertion has been partially undermined by two pieces of evidence: first, the U.S. Navy's building program up through the Vinson Act in 1940 devoted more money to battleship procurement than to building aircraft carriers; second, American fleet tactics as developed in the 1930s were battleship-centric.[17] Yet it is true that the atmosphere of relative scarcity in which the British and Japanese carrier air forces developed were in marked contrast with the situation in the United States. British and Japanese admirals were obliged to ponder anxiously the likelihood of having to fight a "come as you are" war, without the massive infusion of new ships, planes, and pilots that American admirals could largely take for granted. What one historian of D-Day has written in response to critics of the U.S. Army is just as true for the Navy: "To accuse Americans of mass-production thinking is only to accuse them of having a mass-production economy and of recognizing the military advantages of such an economy. The Americans were power-minded."[18] This cornucopia of power would underwrite the swift disintegration of Japan's military position after November 1943.

For the U.S. Navy, the period from Midway to the carrier raids on Rabaul (June 1942–November 1943) embodied two themes: wearing down the Japanese and building up overwhelming strength for the decisive drive across the Central Pacific. This is why operations during that period were largely confined to the Solomons and the southwest Pacific. Before the war, the "Rainbow Five" plan envisioned a drive across the Central Pacific at the earliest possible opportunity. But the need to protect Australia and keep the restless and influential General Douglas MacArthur occupied intervened; Pearl Harbor and carrier losses in 1942 delayed the effort also. But in the southwest Pacific land-based airpower could augment carrier forces until the *Essex* and *Independence*–class ships became fully operational. Between December 1942 and June 1943 *Essex, Lexington,*

Yorktown, Bunker Hill, Independence, Princeton, Belleau Wood, Cowpens, and *Monterey* all commissioned.[19] The Americans, however, refused to rush them into service, preferring to work them and their air groups up to great efficiency before committing them to battle. This decision left a serious gap in available carrier strength throughout the winter and spring of 1943. *Enterprise* being not at 100 percent efficiency due to damage inflicted in autumn 1942, the Pacific Fleet was down to *Saratoga* in May, June, and July 1943. (It was backstopped by the Royal Navy's *Victorious,* which was deployed to the Pacific Fleet from March through July.)[20] Whenever a large carrier force was available (August 1942, November 1943) the U.S. Navy could independently take the offensive, otherwise not. Despite this, MacArthur and Admiral William F. Halsey (then commanding the South Pacific Force) could keep up the pressure on the Japanese, because they had substantial U.S. Army Air Forces and Marine Corps air assets in New Guinea and the Solomons. But by November 1943, when five fleet and four light fleet carriers were ready for action in the Pacific, Admiral Chester Nimitz (commanding the Pacific Ocean Area) could begin his island-hopping campaign at Tarawa with little fear of successful Japanese intervention. In December 1943 Nimitz's Task Force 50, comprising four fleet and two light fleet carriers, could operate independently against Japanese air bases at Kwajelein Atoll with 386 combat aircraft embarked.[21] Carrier aircraft could now cover any attack the Americans chose to make.

The Japanese, by contrast, faced in the period from Midway to the battle of the Philippine Sea a bewildering series of strategic dilemmas that proved well nigh insurmountable. The physical and psychological damage inflicted at Midway haunted the Imperial Japanese Navy and sapped its will; the battles of attrition in the Solomons and New Guinea sapped its strength. No fleet carriers joined the Combined Fleet in 1943, and the two converted liners that were pressed into service in 1942 *(Junyo, Hiyo)* were both inferior to any of the four ships lost at Midway. Although the number of Japanese carriers available often exceeded those of the U.S. Pacific Fleet, Japanese admirals were unwilling to risk them, as more would not be immediately forthcoming; American land-based airpower acted as a further deterrent to offensive action. In addition, the quality of Japanese pilots was in near free fall during 1943, and things would get worse, not better. Lack of fuel curtailed training, a desperate need for new pilots led to a shortened curriculum, and the Combined Fleet refused to release combat-experienced men to become instructors; all three factors took their toll.[22] By the winter of 1943–44 Japanese pilots were lucky to get 275 hours of flight training, while American pilots were not released to squadrons until they had 525 hours in the air.[23] Added to this, the effective assassination of Admiral Yamamoto in April 1943 further

increased the gloom within the IJN. Wherever his successor, Admiral Mineichi Koga, turned, he could perceive only Allied strength and Japanese weakness. The fact that Koga's intelligence picture was at best rudimentary while American intelligence efforts were huge and largely successful did not help matters.[24] Should Koga defend Truk? Bougainville? Rabaul? New Guinea? Should he husband his resources or make a stand somewhere in 1943?[25] The grimness of the situation seems to have paralyzed the upper echelons of the Japanese navy until early in 1944, when the threat of a landing in the Marianas galvanized its planners.

Japanese carrier planes after the Pyrrhic victory at Santa Cruz in October 1942 fought exclusively from land bases until the Combined Fleet's last realistic throw of the dice at the Philippine Sea in June 1944. *Zuikaku, Junyo,* and *Zuiho* had been poised to cover the evacuation of Guadalcanal in January 1943, but the Americans failed to intervene.[26] In April, after a general lull as both sides licked their wounds from Guadalcanal, Yamamoto ordered ninety-six Zeros and sixty-five Vals from his carrier air groups to Rabaul in support of Operation I-GO. The plan was to launch four big air raids on bases in the Solomons and western New Guinea to disrupt Allied operations in the area. Because the defenders were alerted by decrypts of Japanese signals, the raids netted a disappointing twenty-five enemy planes knocked out and a U.S. destroyer, a New Zealand corvette, a tanker, and two transports sunk, at the cost of forty Japanese carrier aircraft. The planes were ordered back to Truk on 17 April.[27] In July ninety-two planes were dispatched from *Junyo, Hiyo,* and *Ryuho* to Rabaul, where all were lost. In November, 150 more aircraft from *Shokaku, Zuikaku,* and *Zuiho* were thrown into the maelstrom after Allied air raids by as many as 213 heavy and medium bombers and 138 P-38 Lightning fighters threatened to neutralize Rabaul, thus uncovering both Bougainville and the northern coast of New Guinea. Half the planes were lost, and the rest were withdrawn after two weeks.[28] The resulting absence of fighters away at Rabaul rendered infeasible any attempt by the Combined Fleet to intervene when the U.S. struck at Makin and Tarawa later in November.

The strategy of diverting carrier planes to Rabaul has often been criticized, but one is left with the impression that Admirals Yamamoto and Koga had little choice. If planes were hard to replace, ships were irreplaceable entirely, and land-based operations did not risk them. If we can see now that pilots were the true key asset and that Japanese pilots by the time of the "Marianas Turkey Shoot" were hopelessly outclassed by more experienced and better trained American ones, all that was probably not so clear in April 1943. Given the power of American land-based air forces in the southwest Pacific, it is difficult to imagine that planes would have fared better operating from carriers than they did deployed to land bases. Furthermore, the Judys and the Jills reaching squadron

service in 1943 were excellent attack planes, and Admiral Jisaburo Ozawa went into battle in June 1944 with more carriers and operational planes—approximately 460 to 420—than Nagumo had at Pearl Harbor.[29] Using carrier planes to protect Rabaul, the key to Japan's entire position in the South Pacific, and to buy time for new ships and planes to come on line must have seemed a good bet. In any case, given the immense American strength then on the way, two hundred pilots saved in 1943 could in no way have turned the tide for Japan in 1944. Therefore, although in theory and hindsight we may find fault with the Japanese decision to use carrier planes to prop up Rabaul, it was probably no worse than doing nothing—an inevitable consequence of Japanese material inferiority vis-à-vis the United States.

For its part, the Royal Navy's Fleet Air Arm was obliged throughout 1942 and 1943 to tailor its force to the defense of convoys and amphibious operations. The FAA's major combat area from Operation PEDESTAL in August 1942 to the Salerno landing in September 1943 was the Mediterranean. With no enemy carrier fleet to contend with, the British needed fighters, fighters, and more fighters to deal with German and Italian aircraft. This led to a skewing of carrier air groups. Whereas *Victorious* was operating a standard mix of twenty-one Albacore torpedo bombers and twelve Fulmar fighters in July 1941, in August 1942 it carried only six Albacores but eighteen Fulmars and six Sea Hurricane fighters. By the summer of 1943 it had embarked thirty-six Martlets (Wildcats) but only twelve Avengers. In May 1942 *Formidable* operated twenty-one Albacores and twelve Martlets; in November 1942 it carried six Albacores, six Seafires, and twenty-four Martlets for Operation TORCH.[30] Thus the 1941 ratio of attack planes to fighters had been reversed. With few if any targets for its Albacores' torpedoes, the FAA failed to garner the wider experience the U.S. Navy and IJN found in the Pacific. When the FAA went back onto the offensive in 1944 it had to readapt to strike missions that were very different than Taranto, Matapan, or the *Bismarck* chase. Although the Royal Navy on average operated as many fleet carriers in the period under discussion as the U.S. Navy or the IJN, smaller air groups and less combat experience left the British carrier fleet behind those of the other two carrier powers in flexibility and striking power. Also, whereas the U.S. Navy could field over nine hundred carrier planes in June 1944 and the Japanese about half that number, in the summer of 1944 squadrons on the Royal Navy's six operational fleet carriers totaled about 288 planes.[31] Thus it was that by the summer of 1944 American carriers were first to reach the critical mass necessary to smash any surface fleet within reach. Ozawa's ships survived the battle of the Philippine Sea because they fled and Admiral Raymond Spruance did not pursue. Potential had been transformed into reality.

All three carrier powers understood the value of carriers, but due to losses, damage, and the relentless need for maintenance there were never enough of them operational to suit any navy in 1942–43. Without carriers, it proved impossible to sustain continuous operations. The timing and pace of campaigns, especially for the Americans and British, were largely determined by the availability of carriers. Although land-based airpower substantially substituted for carrier forces in the southwest Pacific and in Italy (after the Anglo-Americans were firmly ensconced in Sicily and southern Italy), operations like HUSKY, GALVANIC, and later FLINTLOCK (Guam) and ICEBERG (Okinawa) were unthinkable without carriers. Only they could neutralize enemy airfields and counterattacks. Further, the carriers of the United States and Britain became indispensable for the defense of amphibious operations and convoys. Only carriers—fleet, light, and escort—could respond in a quick and timely manner to events in and around distant beachheads. Carrier airpower had become the decisive weapon in naval warfare.

The U.S. Navy, the Royal Navy, and the Imperial Japanese Navy all raced to achieve a critical mass of carriers, pilots, and planes in 1942–43. Ironically, the Japanese and the British, often portrayed as too wedded to the battleship, had become at least as "carrier conscious" in their construction priorities as the Americans. Although the idea that the U.S. Navy had a unique interest in carrier airpower going back to the early 1930s is widespread, it is illuminating to consider that whereas the Royal Navy's 1937 "wish list" of capital-ship strength as of late 1942 was twenty battleships and fifteen carriers, in July 1940 the U.S. Navy's General Board envisioned a future fleet of thirty-two battleships and fifteen carriers.[32] Obviously, the U.S. Navy was as enamored of the big gun as anyone. More concretely, after the British completed the battleships *Anson* and *Howe* in June and August 1942, respectively, and the Japanese commissioned the *Musashi* in August, that was it. Dock space, steel, and labor were shunted thereafter by both Britain and Japan into carrier and antisubmarine escort construction. The British battleship *Vanguard*, under construction in 1942, was given such low priority that it did not commission until 1946, and the Japanese completed *Musashi*'s sister ship *Shinano* as a carrier.[33] The British completed two fleet and five light fleet carriers between Midway and the end of the war, with two more fleet and eleven light fleet carriers still building at the termination of hostilities. Japan completed six fleet and three light fleet carriers between Midway and final defeat.[34]

Yet the United States won the race hands down. Once the primacy of the carrier was established, the Americans applied their vast economic strength and engineering know-how to the problem and so decided the issue.[35] It took time, but economic strength was converted into military power quickly and effectively. Archetypal carrier-versus-carrier battles ceased because in the two years 1942–44 the Americans completely outstripped the competition. They commissioned

sixteen fleet and nine light fleet carriers prior to VJ Day. They also managed to finish five battleships and two battle cruisers of the *Alaska* class between the time of Midway and Nagasaki (although the four *Iowa*s and the *Alaska*s were rather gilded lilies).[36] The Americans also built their ships faster than the other carrier powers. The British fleet carriers *Implacable* and *Indefatigable* took over four years from keel-laying to commissioning. The Japanese fleet carrier *Taiho* took thirty-two months to complete. By comparison, the USS *Intrepid* took twenty months from laying down to completion, *Franklin* twenty-five months.[37] It was thanks to the prodigious output of U.S. shipyards, aircraft factories, and flight training schools that the promise of Midway was fulfilled in the great Central Pacific offensive of late 1943 through 1945.

All weapons systems require time to develop both the numbers and the doctrine necessary for optimal effect in combat conditions. Like the tank before it, carrier airpower needed time to reach a critical mass of units and experienced operators before its full potential could be realized. In the race for the decisive weapon of naval warfare, the navies of Britain, Japan, and the United States all quickly identified the primacy of the aircraft carrier once they were seriously engaged in the war at sea. The United States alone was able to mobilize the financial, technological, and industrial resources needed to procure a force of ships and planes that could humble enemy battle fleets and seize local command of the sea. In this unique ability to manifest huge material and intellectual assets in the form of carrier airpower lie the roots and reality of American naval supremacy from June 1944 until today.

NOTES

1. For the order of battle of the Japanese navy at Midway see Paul Dull, *A Battle History of the Imperial Japanese Navy* (Annapolis, Md.: Naval Institute Press, 1978), pp. 139–41.
2. The standard work is William Y'Blood, *Red Sun Setting* (Annapolis, Md.: Naval Institute Press, 1981).
3. Dull, pp. 175–296; and James F. Dunnigan and Albert A. Nofi, *Victory at Sea: World War II in the Pacific* (New York: William Morrow, 1995), pp. 156–59.
4. Dunnigan and Nofi, pp. 164–65.
5. All ship details in tables and text are, unless otherwise specified, from *Conway's All the World's Fighting Ships 1922–1946* (London: Conway Maritime, 1980).
6. *Eagle* details in E. H. H. Archibald, *Fighting Ships of the Royal Navy* (New York: Military Press, 1984), p. 267.
7. In an interesting sidebar to the controversy over armored protection versus large air groups, the assistant U.S. naval attaché in London, Captain A. G. Kirk, wrote back to the States on 12 December 1940 comparing *Formidable* very favorably with *Yorktown*. He believed *Formidable*'s extra protection a better bet in a war against Japan than the bigger U.S. air groups. See Record Group 38, Intelligence Division Confidential Reports of Naval Attachés, box 1202, U.S. National Archives, College Park, Maryland.

8. Andrew Faltum, *The* Essex *Class Carriers* (Baltimore: Nautical and Aviation, 1996), p. 34.
9. Statistics on the battle of Santa Cruz from S. E. Morison, *The History of U.S. Naval Operations during the Second World War* (Boston: Little, Brown, 1949), vol. 5, pp. 204–206; at the Philippine Sea *Zuikaku* carried twenty-seven Zeros, twenty-seven Judys, and eighteen Jills. See Y'Blood, app. 2.
10. Roy Grossnick, *U.S. Naval Aviation 1910–1995* (Washington, D.C.: Naval Historical Center, 1997), p. 448; and Stephen Roskill, *The War at Sea* (London: H.M. Stationery Off., 1956), vol. 2, p. 450.
11. Admiralty file ADM 239/261, p. 49, The National Archives (TNA): Public Record Office (PRO).
12. Correlli Barnett, *Engage the Enemy More Closely* (New York: Norton, 1991), pp. 129–39.
13. Ibid., p. 244.
14. See file ADM 1/15576, "Operational Grouping of Carriers," TNA:PRO.
15. J. Greene and A. Massignani, *The Naval War in the Mediterranean 1940–1943* (Rochester, Kent, U.K.: Sarpedon, 1998), pp. 36–37.
16. Quote from Richard Overy, *The Air War 1939–1945* (London: Europa, 1980), p. 142.
17. Trent Hone, "The Evolution of Fleet Tactical Doctrine in the U.S. Navy, 1922–1941," *Journal of Military History* 17, no. 4 (October 2003), pp. 1107–48, shows that the battle fleet remained the core of the interwar navy and was seen as the weapon of decision by fleet commanders. It was the damage inflicted to the battle line at Pearl Harbor that forced the U.S. Navy to adopt the carrier.
18. Quoted in Peter Paret, *Makers of Modern Strategy* (Princeton, N.J.: Princeton Univ. Press, 1986), p. 691.
19. For the commissioning dates, Norman Polmar, *Aircraft Carriers* (Garden City, N.Y.: Doubleday, 1969), p. 315.
20. John Winton, *Find, Fix and Strike!* (London: Batsford, 1980), p. 87.
21. Morison, vol. 7, pp. 116, 190.
22. Harry Gailey, *The War in the Pacific* (Novato, Calif.: Presidio, 1995), pp. 63–64; Eric Bergerud, *Fire in the Sky* (Boulder, Colo.: Westview, 2000), pp. 666–67; and Dunnigan and Nofi, pp. 50–51.
23. Eric Grove, *Sea Battles in Close-Up* (Annapolis, Md.: Naval Institute Press, 1993), vol. 2, p. 174. Overy (*The Air War 1939–1945,* p. 144) shows how the situation deteriorated even further after June 1944.
24. For the relative intelligence information from this period see John Prados, *Combined Fleet Decoded* (New York: Random House, 1995), esp. pp. 481–515.
25. For Koga's dilemma see John Costello, *The Pacific War* (New York: Quill, 1981), pp. 420–39, and Gailey, pp. 237–41.
26. Dull, p. 259.
27. Details of I-GO from Dull, pp. 272–73; Bergerud, pp. 425–26; and Stephen Howarth, *The Fighting Ships of the Rising Sun* (New York: Scribner's, 1983), p. 317.
28. Bergerud, pp. 426–27.
29. Nagumo had six fleet carriers for the Pearl Harbor raid, Ozawa had five fleet and four light fleet carriers. See Y'Blood, apps. 1 and 2.
30. British carrier air groups are enumerated in Winton, pp. 54, 73, 78–79, 82–83.
31. Ibid., pp. 112–13, 117–18.
32. ADM 1/9081; and Joel Robert Davidson, *The Unsinkable Fleet* (Annapolis, Md.: Naval Institute Press, 1996), table 1.
33. *Conway's,* pp. 15–16, 178.
34. Ibid., pp. 21–23, 183–84.
35. For the sheer scale of U.S. economic power see John Ellis, *Brute Force* (New York: Viking, 1990), esp. pp. 443–524, and Paul Kennedy, *The Rise and Fall of the Great Powers* (New York: Viking, 1988), pp. 320–56.
36. *Conway's*, pp. 98–99, 104–105, 122. For a comparison of British and American warship construction see James Levy, *The Royal Navy's Home Fleet in World War II* (Basingstoke, U.K.: Palgrave, 2003), p. 191 note 157. The fifth battleship mentioned as being completed was USS *Alabama* (BB 60), in August 1942.
37. Faltum, p. 168.